Vice-Consul at Fortaliza; Mr. Reidy, Manager of the Western Brazilian Submarine Telegraph Company; Mr. P. O'Meara, late Chief Engineer of the Port Works, Ceara; M. N. Olsen, Fortaliza, Ceara; Colonel Jas. Brigido, Ceara; and the Directors of the Royal Mail Steamship Company.

1894 *May* 2.

Two Questions on Mr. Stone's Proposed Correction to the Measure of Time. By Professor Simon Newcomb.

From Mr. Stone's note on p. 288 of the *Monthly Notices* for March it would seem that he has not carefully read the short Paper to which his note alludes. This Paper contains no attempt to disprove Mr. Stone's views, nor were any quantities in his theory neglected; on the contrary, the Paper was principally an attempt to apply his theory, as he states it, to the special case of the transit of the Moon observed at Oxford on 1892 January 6, on the supposition that the use of Le Verrier's tables, and the consequent introduction of the new measure of time, commenced in 1892. An inconsistency was found, and Mr. Stone was asked to explain it. He says nothing about this observation, and gives no explanation of the inconsistency. I therefore beg that Mr. Stone will answer these two questions:—

(1) What would have been the tabular error of Hansen's tables of the Moon given by the transit observed at Oxford on 1892 January 6, and printed on p. 4 of the *Monthly Notices* for the present session, if Carlini's tables of the Sun had been continued in use in the *Nautical Almanac* until the present time?

(2) What would have been the tabular error given by the same observation had Carlini's tables been continued until the end of 1891 and Le Verrier's introduced for the first time in 1892?

Either Mr. Stone can answer these very simple questions or he cannot. If he can answer them, I respectfully submit that it is only just to himself that he should do so, giving the numerical computation in each of the two cases fully enough to be understood, comparing it with the actual computation on p. 4, and showing how the result follows from his theory. If he cannot answer them, nothing more need be said.

Reply to Professor Newcomb's Two Questions. By E. J. Stone, M.A., F.R.S., Radcliffe Observer.

Before answering Professor Newcomb's two questions, I feel it necessary to call attention to his statement that in the *Monthly Notices* for March he applied my theory to the special case of the transit of the Moon at Oxford on 1892 January 6, and "without neglecting any quantities in my theory" was led to an inconsistency. Now, this statement is certainly inaccurate. It is simply because Professor Newcomb has neglected certain quantities which, if my views of the physical bases of our time-measures are sound, cannot be neglected without error, that the inconsistency arises; and in my reply I called Professor Newcomb's attention to this point as the real one at issue, but apparently without success.

I now come to Professor Newcomb's questions.

1. "What would have been the tabular error of Hansen's tables of the Moon given by the transit at Oxford on 1892 January 6 if Carlini's tables of the Sun had been continued in use in the *Nautical Almanac* until the present time?"

I understand by this question that the data given in the *Nautical Almanac* are supposed to have been continuously *used for the computation of our "sidereal times at mean noon," and in the actual determinations of our local sidereal times*, and not merely printed without being used. In this case the answer is that the R.A. from Hansen's tables *minus* observed R.A. on 1892 January 6 would have been $= -0^s\cdot10$, the result which is given in the *Monthly Notices* for November, and is quoted by Professor Newcomb under the form "Hansen *minus* observed, corrected." I have published the answers to *this and similar questions for all the observations of the Moon made at Oxford since* 1880.

2. The answer to the second question is that the effects produced on $-0^s\cdot10$, in the supposed case, would be very small; for they would merely be those due to the difference between the "local sidereal time," which would, if no change had been made, have been accepted by astronomers as 1892 January 1, subject, of course, to any errors of that assumption, and that which would have been accepted as the epoch 1892 January 1, the instant of departure for the new system of time-measures, together with the difference between the sidereal equivalents for the two different intervals of absolute time used as "unit days" before and after the change, multiplied by the number of "unit days" which had elapsed since the change was made, which in the cases supposed would be equal

$$5\times\left[86400^s\left(\frac{N+\delta N}{N_0}+\frac{N+\delta N}{2\pi}\right)-86400^s\left(\frac{N}{N_0}+\frac{N}{2\pi}\right)\right]$$
$$=5\times86400\,\frac{dN}{N_0}\left(1+\frac{N_0}{2\pi}\right)$$